A Colorimetric Characterization of the Raw Digital Data of the Visible Human Dataset Images

[*†]Stefano Bonacina, EE, [*†]Marco Masseroli, Ph.D, [*]Francesco Menegoni, [§]Giorgio Quattrone, [*†‡]Francesco Pinciroli, Professor
[†] Dipartimento di Bioingegneria, [*] Politecnico di Milano, Milan – Italy
[‡] also with Istituto di Ingegneria Biomedica, Centro di Ingegneria Biomedica, Consiglio Nazionale delle Ricerche, Milan – Italy, [§]CILEA Consortium, Milan - Italy

Abstract

A colorimetric characterization of the all about 9 thousand Visible Human Dataset (VHD) cryosectioned color images of the male and female body is described here. Such characterization is performed keeping limited the computational time besides the high resolution of the considered VHD images. The about 27 thousand distinct histograms obtained are downloadable from the VHD Milano Mirror Site® ftp server.

Introduction

The Visible Human Dataset (VHD) consists of digital images of two cadavers, a male and a female. Female and Male dataset contains color pictures of anatomic serial sections: over than 5000 images for the Female and over than 3700 – "classical" and the higher resolution - images for the Male [1].

The contouring of relevant anatomic structures present in an image is one of the top problems regarding any anatomic image. The availability of preliminarily quantitative characterizations of the images can help in targeting better the contouring task. Sets of three red, green and blue intensity histograms for each VHD color image in RGB color space, stored on a server and made accessible like the VHD images themselves, represent a potentially useful resource to many developers working on the VHD raw data.

In this study we describe an histogram-based colorimetric characterization of all the VHD 24-bit color images.

Materials and Methods

The axial section anatomic color images of the Visible Human Male and Female are explained in detail in [1]. From each VHD color image, we obtained three histograms, one for each color component. To perform this task we have used the following method. First, we downloaded the color image raw files from the VHD Milano Mirror Site® ftp server; second, we obtained three monochrome 8 bit images from each 24 bit VHD color image, using a developed agent that automatically detects VHD image format. Third, the agent performed histogram calculation and storing. Histograms were stored on hard disk in two formats: binary to be read quickly by other programs, and eXtended Mark-up Language (XML) format. Storing sequentially in a file the number of pixels for each intensity level Binary format was obtained. The XML format was obtained storing in a file into XML tags the number of pixels for each intensity level. For each image six files – three in binary and three in XML format – for a total of 48 KBytes were generated.

We implemented algorithms in C++ programming language, to maintain computational time limited.

Results

The meta analysis performed is intended as service for developers of applications based on the VHD data. The time needed to perform the second and the third steps of the colorimetric characterization algorithm explained above, varied from 15 to 30 seconds per image. The memory occupation of each histogram file was of 1 Kbyte in binary format, and of 15 Kbytes in XML format.

We maintained the original color image name in the dataset to naming histograms. Thus, the generic histogram is labeled by a tag containing the section number, the gender (male or female), the color component (red, green, or blue). For example, 1445.rgb_r_ist indicates the red color component histogram of the 1445.rgb high resolution image of the male. As for the raw color images, sets of corresponding histograms are stored on the server according to the region body, so over than 54 thousand files are available.

Conclusions

We have performed colorimetric characterization, by means of color histograms, of all the VHD color images. An amount of about 27 thousand histograms was generated, and are available as binary files and XML files to be downloaded from the VHD Milano Mirror Site®.

References

1. Ackerman MJ. The United States National Library of Medicine. The Visible Human Project. [Online] 1995. Available from: http://www.nlm.nih.gov/research/visible/visible_human.html. Last access: March 12, 2003.